Results of the 1991 Ohio Crop Management Survey.

Marvin T. Batte
Department of Agricultural Economics and Rural Sociology
The Ohio State University
ESO 2021

Ohio farmers use a variety of farming systems. These vary greatly in the way they use labor, machinery, and chemical inputs. It is expected that they perform differently in response to alternative weather conditions. We also suspect that farmers using these systems may vary by farm size, degree of enterprise diversity, by degree of employment off the farm, or by other attributes. The 1991 Crop Management Survey was conducted to study these and other issues associated with these alternative farming practices.

In April, 1992, two groups of farmers were identified, contacted by mail and asked to provide information regarding their production experiences for the 1991 production year. A sample of 550 farmers was scientifically selected to be representative of Ohio Agriculture. The sample included farms of all sizes and all enterprise types. These farmers were asked a number of questions about their cropping system, including tillage method, fertility management, pest and weed control methods, machinery investment, and cost and return measures. Fifty-five percent of these surveys were returned yielding 222 usable responses.

Because ridge-tillage methods have been adopted by a relatively small proportion of Ohio farmers, it was expected that very few ridge-till farmers would appear in the random sample. For this reason ridge-till farmers were identify separately. All known ridge-till farmers in Ohio received a questionnaire. Nearly 58 percent of these surveys were returned. Of these, 75 were completed by farmers who utilize ridge-tillage on a portion of their acreage.

In the analyses that follow, farmers from both samples are categorized by primary tillage method and compared on the basis of fertility and pest control methods and on financial performance. Only commercial-sized farms (here defined as farms with gross sales greater than $40,000 annually) are included in these analyses.

About the sampled farms

Table 1 presents summary statistics for farmers summarized by primary method of tillage. Four primary tillage systems were identified -- No-till, ridge-till, moldboard-plow and reduced-till. Reduced tillage includes farmers who use a chisel plow or disc for primary tillage. Each surveyed farmer is associated with one column in table 1 -- the tillage system use on the majority of their acreage. Farmers who used two or more tillage systems with no system being used on over half of cropped acreage are included in the **Mixed-Systems** category.

Table 1: Farm description by primary tillage method.

	Primary Tillage System				
Measure	Ridge-Till	No-Till	Reduced-Till	Moldboard Plow	Mixed System
Number of Farms	28	25	57	25	30
Total farm acreage	579.4	537.2	567.3	376.6	649.5
Cropped acreage	534.9	434.2	471.7	316.8	546.4
Percent leased land	59.3	42.8	60.9	45.4	45.3
Farms with livestock (%)	27.5	51.5	55.5	86.2	74.6
Average Operator Age (yrs)	42.3	47.0	44.4	50.7	48.5
Operators working off-farm:					
Seasonally (%)	8.3	6.3	14.5	5.8	6.4
Year-around (%)	33.6	29.5	33.7	26.9	34.4

Farm size does vary significantly among the tillage groups. The mixed tillage systems group had the largest average farm size (650 total acres and 546 cropped acres). This helps explain why multiple tillage systems are used on

these farms. Their larger acreage makes it easier to justify the expense of two sets of primary tillage equipment and they probably have more diversity in cropland characteristics. Ridge-till farms had the next largest average farm size (535 cropped acres). Farmers using the moldboard plow had the smallest cropped acreage. There also was a substantial difference in the percentage of farmers in each group involved in livestock production. Less than 28 percent of ridge-till farmers had livestock on the farm. Just over half of the no-till and reduced-tillage farmers had livestock. Those farmers with moldboard-plow and mixed-systems much more frequently had livestock enterprises.

Operator age and off-farm employment also varied significantly. Ridge-till farmers had the youngest average age (42.3 years), followed by reduced-till farmers (44.4 years). Moldboard-plow farmers had the highest average age, at just over 50 years. Substantial numbers of farmers in each tillage group worked away from the farm. Reduced- and ridge-till farmers most frequently work off-farm -- each with one-third of its operators working away from the farm year-around. Moldboard-plow and no-till farmers had the lowest percentage of farmers working off farm -- but still with more than 30 percent working away from the farm.

Table 2 highlights the tillage practices for each tillage system category. From this, it is apparent that farmers in all but the mixed category operated primarily with a single system. On average, ridge-till farmers used this method on 93 percent of their cropped acreage; No-till farmers used no-till practices on 84 percent of cropped acreage; Reduced-till farmers used the chisel plow on 60 percent of their cropped acreage, and discing was the primary tillage on 16 percent; Moldboard plowing was done on 80 percent of cropped acreage for the moldboard-plow group.

Table 2. Percentage of acres tilled with various primary tillage methods.

	Primary Tillage System				
Measure	Ridge-Till	No-Till	Reduced-Till	Moldboard Plow	Mixed System
Primary tillage method	Percent of cropped acres				
Ridge-till	92.7	0.4	0.7	0.0	7.4
No-till	1.0	83.8	5.8	9.1	11.7
Chisel Plow	2.6	13.0	60.4	4.2	30.6
Discing Only	2.9	0.0	15.8	5.9	6.3
Moldboard	0.7	2.7	16.7	80.1	33.6
Other	0.0	0.0	0.7	0.6	10.4

A number of questions were asked regarding the cultural practices involved in fertility management and pest control (Table 3). The first question asked whether fertilizers were applied in bands or were broadcast. Ridge-till farmers most frequently used banding of fertilizers -- Fifty-four percent banded all fertilizers and 34 percent banded some fertilizers. Moldboard-plow farmers more commonly applied fertilizers by broadcast. Even though these farmers differed substantially in how they applied fertilizers, there is not a large amount of difference in the rate of fertilizers applied. The farmers were asked how much actual nitrogen was applied per acre for the corn crop. Averages ranged from 141 pounds per acre for the mixed tillage system group to nearly 153 pounds for the reduced-till group. Livestock manure may have provided additional N, but we did not ask questions about the quantity, analysis, or type of manure applied to the corn crop.

Weed control is another item of substantial cost for most Ohio farmers. Farmers were asked how they applied herbicides in their farming system (Table 3). Almost all farmers made use of herbicides in 1991, but method of application varied considerably. Most ridge-till farmers controlled weeds by band-spraying herbicides to protect the row and using cultivation to control weeds in row middles. Most farmers in the other tillage systems applied herbicides as a broadcast. The survey did not obtain information about the amount of herbicide material applied per acre.

Crop mix and yield

Both the mix of crops grown and yield performance varied among the tillage categories for 1991 (Table 4). Ridge-till farmers used a crop mix that was dominated by corn and soybeans -- these crops accounted for over 92 percent of ridge-till crop acreage. Farmers in the other tillage categories included more wheat and other small grains in their rotations as

well as more hay crops.

The 1991 production season was impacted powerfully by a season-long drought. State average yields for corn, soybeans and wheat were 96, 36 and 49 bushels per acre, respectively. Yields for the sampled farmers were very close to these estimates, averaging 96.9, 38.3 and 52.7 bushels per acre for corn, soybeans, and wheat. However, there was substantial variation among farmers in different tillage categories. Ridge-till farmers reported the highest corn yields at nearly 109 bushels. Moldboard-plow farmers had the next highest corn yields, averaging nearly 100 bushels per acre. Reduced-till and mixed-system farmers were near the state average yield, while no-till farmers reported the lowest average corn yields.

Yield results were different for the soybean crop. Mixed-system farmers reported the highest average soybean yields, followed by reduced-till and ridge-till farmers. No-till and moldboard-plowed beans had the lowest per-acre yields.

Table 3. Fertility and weed control practices by tillage method.

Measure	Primary Tillage System: Ridge-Till	No-Till	Reduced-Till	Moldboard Plow	Mixed System
Fertilization application method			Percent		
Banded	53.8	10.7	5.7	0.0	19.0
Broadcast	7.7	13.3	20.1	31.9	29.7
Banded on some acreage, broadcast on other acre	2.8	38.5	41.8	51.7	33.2
Some fertilizers are banded, others are broadcast	34.0	37.4	32.3	16.4	18.1
No fertilizers used in 19	1.8	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0
Actual N applied per acre of corn			Percent		
Less than 100 pounds	6.3	5.9	7.7	15.0	11.1
100 - 150 pounds	32.2	29.4	28.8	20.0	37.0
150 - 200 pounds	41.9	58.8	48.1	50.0	40.7
More than 200 pounds	19.6	5.9	15.4	15.0	11.1
Total	100.0	100.0	100.0	100.0	100.0
			Pounds		
Average actual N per corn acre	149.8	151.6	152.8	151.3	141.3
Herbicide application method			Percent		
Banded	52.3	11.6	9.4	3.0	10.2
Broadcast	19.7	84.2	76.8	85.6	68.3
Banded on some acreage, broadcast on other acre	4.5	0.0	10.0	11.4	16.1
Some herbicides are banded, others are broadcast	23.5	0.0	0.0	0.0	5.4
No herbicides used in 199	0.0	4.2	3.8	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0

Financial Performance

We asked the survey participants a number of questions regarding income and expenses for the 1991 production season. Farmers were asked to provide information from their tax returns so as to maintain as much consistency as possible in our measures. These measures are reported in Table 5.

Table 4. Crop mix and yields by tillage method.

Measure		Primary Tillage System: Ridge-Till	No-Till	Reduced-Till	Moldboard Plow	Mixed System
Crop			Percent of cropped acres			
Corn		53.4	42.5	39.5	29.0	37.9
Soybeans		39.1	41.2	35.5	38.6	37.8
Wheat		2.5	6.9	12.2	16.4	7.9
Hay		2.9	6.1	7.9	10.3	9.3
Others		2.0	3.2	4.9	5.7	7.0
		100.0	100.0	100.0	100.0	100.0
Crop			1991 Yield			
Corn	(bu/ac)	108.9	85.2	93.3	99.8	95.0
Soybeans	(bu/ac)	37.0	36.6	37.4	36.3	42.0
Wheat	(bu/ac)	45.3	55.2	51.6	51.9	57.3
Hay	(ton/ac)	3.1	3.7	3.2	3.2	3.4

Gross receipts varied substantially across farm type. This is as expected since farm size also varied greatly among the tillage groups as did the percentage with livestock. Net farm income, although still a function of farm size, is also expected to be strongly related to yield performance and input use efficiencies. Ridge-till farmers had both the highest gross and net farm incomes. Reduced-tillage farmers had the next highest net farm income ($17,083) followed by mixed-system farmers, moldboard-plow farmers, and no-till farmers.

Table 5. 1991 farm cost and returns by tillage method.

Measure	Primary Tillage System: Ridge-Till	No-Till	Reduced-Till	Moldboard Plow	Mixed System
Total farm:					
Gross reciepts	$170,955	$127,938	$137,504	$93,026	$150,739
Net farm income	26,241	6,086	17,083	12,043	14,044
Per acre expenses					
Fertilizers and lime	$31.26	$29.15	$31.19	$22.11	$36.25
Herbicides and pesticides	15.10	23.52	15.46	15.90	22.13
Hired labor	9.74	9.03	14.77	5.80	10.10
Machinery investment	236.86	252.83	272.91	345.33	227.63

Because these tillage systems use labor, machinery and chemicals in greatly different ways, there is much interest in the level of per acre costs for these inputs. Mixed-system farmers reported the highest per acre expense ($36.25) for fertilizer and lime, followed (in decreasing cost order) by ridge-till, reduced-till, no-till and moldboard-plow farmers. Per acre cost of herbicides and pesticides also varied substantially. Ridge-till, reduced-till and moldboard-plow farmers reported values that were approximately equal -- $15 to $16 per acre. No-till and mixed-system farmers reported expenditures on the order of 50 percent higher. Per acre machinery investment numbers ranged from a low of $227.63 for mixed-system farmers to $345.33 for moldboard-plow farmers. These also happened to be the farm categories with the largest and smallest crop acreages, respectively.

Conclusions

The 1991 Crop Management Survey was conducted to learn more about differences among farmers using different tillage systems and other cultural practices. Results suggest that were major differences in the performance of these systems in 1991. Crop yields varied greatly as did farm net earnings. In drought years, no-till systems usually are expected to preform relatively better than other tillage systems. However, this was not the case for the 1991 drought. No-till farmers had the lowest corn yields, averaging about 10 bushels less than the state average. This translated to net farm earnings that also were below average for the state.

Caution should be used in interpreting these results. These results represent but one year's experience. Yield performance may be greatly different from those reported in other years. We plan to continue to survey farmers again in 1992 and subsequent years to get better estimates of yield performance in a variety of conditions.